3.1 AIR QUALITY

3.1.1 Affected Environment

In the State of Nevada the airshed boundaries are considered to correspond to those of the hydrographic regions, and are treated as such in this chapter. Nevada airshed boundaries correspond to eight of the hydrographic regions in the Humboldt, Pershing, Churchill, Washoe and Lyon counties.

3.1.1.1 Regional Setting

Lands under consideration for leasing under this action do not include wilderness areas, ACEC, or the Black Rock Desert – High Rock Canyon Emigrant Trails NCA. Also excluded are tribal lands managed by the Bureau of Indian Affairs, the Sheldon National Wildlife Refuge and private lands with titles that include geothermal mineral rights.

Table 3.1-1 groups the KGRAs and PVAs (including the lease application areas) by hydrographic region (airshed) and county, and also lists the ACEC, NCAs and Indian Reservations within each county. The greatest number of KGRAs and PVAs lie within Hydrographic Regions 2 (Black Rock Region), 4 (Humboldt River Basin), and 10 (Central Region), with one PVA in Hydrographic Region 1 (Northwest Region) and one KGRA and a portion of PVA 8 in Hydrographic Region 5 (West Central Region). Portions of PVA 8 fall within Hydrographic Region 6 (Truckee River Basin) and 8 (Carson River Basin).

The purpose of plan requirements, initial air quality classifications, increments, and ceilings for Federal Class I and II areas are described in the Clean Air Act[7] Sections 160 to 169. Class I Federal lands apply to attainment areas and include national parks, national wilderness areas and national monuments which are granted special air quality protection under section 162 (a). In the state of Nevada only the Jarbridge Wilderness Area in the Elko County has been designated as a Class I area. All other attainment areas within Nevada, which have not been designated as Class I areas, are Class II areas.

There are therefore no mandatory Class I Federal areas within any of the eight geothermal assessment areas under consideration. Class 1 areas closest to the geothermal assessment areas are:

- National Park Service Class I areas to the west in California (Lava Beds National Monument, Lassen Volcanic National Park)

- Forest Service Class I Wilderness Areas to the west in California (South Warner Lakes, Caribou, Thousand Lakes), and to the east in Nevada (Jarbridge)

[7] Clean Air Act of 1970 (P.L. 91-604 ((42 USC §7401; 40 CFR Parts 51 and 93) as amended by P.L. 91-631 and P.L. 101-549)

There are no Fish and Wildlife Service Class I units or American Indian Class I lands close by. However, 40 CFR Section 51.307 stipulates that the operator of any new major stationary source or major modification located within 100 kilometers of a Class I area must contact the Federal Land Managers for that area. Of the above mentioned Federal Class I areas, only the South Warner Lakes area is of concern.

TABLE 3.1-1
NATIONAL FORESTS, WILDERNESS AREAS, NATIONAL WILDLIFE REFUGES, NATIONAL MONUMENTS, AND INDIAN RESERVATIONS (GROUPED BY AIRSHED (HYDROGRAPHIC REGION) AND COUNTY)

Airshed (Hydrographic Region)		County	KGRA	PVA*	National Parks, Wilderness Areas, National Monuments, Indian Reservations within Airshed (Hydrographic region)	Class I Areas**
1	Northwest Region	Humboldt		1	Sheldon National Wildlife Refuge Lahontan Cutthroat Trout Natural Area	South Warner Wilderness
		Washoe				
2	Black Rock Region	Humboldt		2, 3, 4, 5, (7)	Black Rock Desert-High Rock Canyon-Emigrant Trails NCA Humboldt Toiyabe National Forest Summit Lake Indian Reservation Fort McDermitt Indian Reservation	South Warner Wilderness
		Washoe	Gerlach, San Emidio		Pyramid Lake Indian Reservation Black Rock Desert-High Rock Canyon-Emigrant Trails NCA	
		Pershing		(8)		
4	Humboldt River Basin	Humboldt		6, 7	Humboldt Toiyabe National Forest Winnemucca Indian Reservation	
		Pershing	Rye Patch	9, 11, (8)		
		Churchill		(8)		
		Elko				

Airshed (Hydrographic Region)		County	KGRA	PVA*	National Parks, Wilderness Areas, National Monuments, Indian Reservations within Airshed (Hydrographic region)	Class I Areas**
		Lander			Battle Mountain Indian Reservations	
5	West Central Region	Pershing		8		
		Churchill	Brady	(8)		
		Lyon			Fernley Wildlife Management Area	
6	Truckee River Basin	Washoe			Pyramid Lake Indian Reservation Reno-Sparks Indian Reservation	
		Pershing		(8)		
		Storey				
7	Western Region	Washoe				
8	Carson River Basin	Churchill		(8)	Fallon National Wildlife Refuge Stillwater Wildlife Management Area	
		Pershing				
9						
10	Central Region	Pershing	New York Canyon, (Dixie Valley)	10, 12, 13		
		Churchill	Dixie Valley			
		Lander				

* Areas falling partly in a county are shown in parenthesis
** Areas within 100 kilometers of lease application

3.1.1.2 Meteorology and Air Quality

Presently the air quality within the Winnemucca District is good except for periods during late spring, summer, and early fall when particulate concentrations (dust) become excessive. During winter, stagnating air masses called anticyclones often remain over the region for two or more days preventing vertical atmosphere movement and thus causing atmospheric mixing depths to remain shallow. This condition is prevalent over Nevada from November through January. There is also a high frequency of occurrence of light wind speeds from October through January. These phenomena—stagnating anticyclones, shallow atmospheric mixing depths, and light winds—all tend to allow air pollution to accumulate. However, because the area is virtually undeveloped and free of pollution sources, these meteorological conditions cause little impact on the air quality in the area.

Meteorological results from Winnemucca, Valmy and mines in northern Nevada indicate winds of 8-10 miles per hour, with wind directions showing a general bimodal distribution, the primary mode being south southwesterly for the summer months and the secondary mode north northeasterly during the winter. The ground level wind directions in Nevada are locally modified by the southerly to south southwesterly trending mountain ranges and valleys of the "Basin and Range" topography of this region.

None of the lease application areas are located in non-attainment areas for either particulates or ozone (except Washoe County which is in marginal non-attainment for the 1 hour ozone standard). The Class II air quality area located closest to the application sites and PVAs is the Black Rock Desert – High Rock Canyon Emigrant Trails NCA. This action does not involve non-attainment areas, and emissions from the development and production would be negligible, so that it should conform to the State of Nevada Implementation Plan.

Except for particulate concentrations (dust) during certain times of the year, other pollution emission forms are inconsequential within the assessment area. In future years other pollutant sources may become important particularly if industrialization or population increases occur within the area. There is also the possibility of outside emission sources affecting the ambient air quality of the area.

Windborne dust from west-southwesterly winds blowing across the Black Rock Desert in late spring, summer, and early fall causes a degradation of air quality in the region. Reportedly, dust generated in the Black Rock Desert is carried across the State, reaching Elko during severe low-pressure disturbances.

Wildfires or prescribed burning in the area occasionally emit particle matter (smoke) into the air, producing noticeable deterioration of air quality within the area. Subsequently, these areas are exposed to wind erosion, which suspends ash and soil particles in the air.

For the hydrographic regions under consideration, Washoe County (Hydrographic Region 1, 2, 6 and 7) is in marginal non-attainment for ozone (O_3). The other areas have achieved attainment for all six criteria pollutants (carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter-10 microns (PM_{10}), O_3, and sulfur dioxide (SO_2)). Table 3.1-2 shows that

PM_{10} levels measured at various urban State and Local Air Monitoring Station (SLAMS), National Air Monitoring Station (NAMS) and Special Purpose Monitoring Station (SPMS) sites are well within the U.S. Environmental Protection Agency (EPA) standard annual value of 50 $\mu g/m^3$. The rural Interagency Monitoring of Protected Visual Environments (IMPROVE)[8] program monitoring in surrounding counties sites show PM_{10} levels below $10\mu g/m^3$. It is expected that these levels would not rise significantly during activities within any of the PVAs.

TABLE 3.1-2
PM_{10} LEVELS MEASURED AT URBAN SLAMS, NAMS, AND SPMS SITES

Airshed (Hydrographic Region)		County	Monitoring Site	PM_{10} Level, Annual Average $\mu g/m^3$	Year Sampled
1	Northwest Region	Humboldt			
		Washoe			
2	Black Rock Region	Humboldt			
		Pershing			
		Washoe			
4	Humboldt River Basin	Humboldt			
		Pershing	Lovelock (SPMS/SLAMS)	24	1997
		Churchill			
		Elko			
		Lander	Battle Mountain (SLAMS)	24	1999
5	West Central Region	Pershing			
		Churchill			
		Lyon	Fernley (SPMS)	16	1998
6	Truckee River Basin	Washoe	Sparks (NAMS/SLAMS)	27	2000
			Galletti (NAMS/SLAMS)	42	2000
			Incline (SPMS/SLAMS)	16	2000
			Reno (NAMS/SLAMS/SPMS)	31	2000
			Toll Road (SPMS)	21	2000
			Mustang (SPMS)	16	1997
		Pershing			

[8] The IMPROVE program is a cooperative measurement effort governed by representatives from Federal and regional-state organizations. It was established in 1985 to aid the creation of Federal and State implementation plans for the protection of visibility in Class I areas as stipulated in the 1977 amendments to the Clean Air Act.

Airshed (Hydrographic Region)		County	Monitoring Site	PM_{10} Level, Annual Average $\mu g/m^3$	Year Sampled
		Storey			
7	Western Region	Washoe			
8	Carson River Basin	Churchill			
		Pershing			
9					
10	Central Region	Pershing			
		Churchill			
		Lander			
	Regional Background Sites	White Pine	Great Basin National Park (IMPROVE)	6	2000
		Elko	Jarbidge Wilderness Area (IMPROVE)	8	2000
		Lassen	Lassen Volcanic National Park (IMPROVE)	5	2000

General provisions for preventing of air pollution and for employees' health and safety are included in the leasing and operating regulations. In addition, Federal Air Quality Standards and Nevada Air Quality Regulations are applicable. Lease stipulations and conditions of approval for specific permits are issued to ensure that impacts related to air quality standards and public health and safety do not cause violations during construction and regular operational periods. Post leasing operations would be required to comply with air quality standards and to obtain the necessary permits.

The Clean Air Act requires the EPA to set National Ambient Air Quality Standards for pollutants considered harmful to public health and the environment. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. The Nevada Division of Environmental Protection, Bureau of Air Quality is charged with maintaining and improving the air quality within the State of Nevada (excluding Washoe and Clark Counties, which have their own jurisdictions) and setting Ambient Air Quality Guidelines. Table 3.1-3 lists the Nevada and Federal Ambient Air Quality Standards.

TABLE 3.1-3
STATE OF NEVADA AND FEDERAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	Nevada Standards		National Standards		
		Concentration	Method	Primary	Secondary	Method
Ozone (O_3)	1 hr	235 $\mu g/m^3$	Chemoluminescence	235 $\mu g/m^3$	235 $\mu g/m^3$	Chemoluminescence
Carbon monoxide (CO) <5,000 ft above sea level	8 hrs	10,000 $\mu g/m^3$	Nondispersive Infrared	10,000 $\mu g/m^3$		Nondispersive Infrared
Carbon monoxide (CO) >5,000 ft above sea level	8 hrs	6,670 $\mu g/m^3$	Nondispersive Infrared	10,000 $\mu g/m^3$		Nondispersive Infrared
Carbon monoxide (CO) at any elevation	1 hr	40,000 $\mu g/m^3$	Nondispersive Infrared	40,000 $\mu g/m^3$		Nondispersive Infrared
Nitrogen dioxide (NO_2)	Annual arithmetic mean	100 $\mu g/m^3$	Chemoluminescence	100 $\mu g/m^3$	100 $\mu g/m^3$	Chemoluminescence
Sulfur dioxide (SO_2)	Annual arithmetic mean	80 $\mu g/m^3$	Ultraviolet fluorescence	80 $\mu g/m^3$		Pararosaniline
Sulfur dioxide (SO_2)	24 hrs	365 $\mu g/m^3$	Ultraviolet fluorescence	365 $\mu g/m^3$		Pararosaniline
Sulfur dioxide (SO_2)	3 hrs	1,300 $\mu g/m^3$	Ultraviolet fluorescence		1,300 $\mu g/m^3$	Pararosaniline
Particulate matter PM_{10}	Annual arithmetic mean	50 $\mu g/m^3$	High volume PM_{10} sampling	50 $\mu g/m^3$	50 $\mu g/m^3$	High volume PM_{10} sampling

Pollutant	Averaging Time	Nevada Standards		National Standards		
		Concentration	Method	Primary	Secondary	Method
Particulate matter PM_{10}	24 hrs	150 $\mu g/m^3$	High volume PM_{10} sampling	150 $\mu g/m^3$	150 $\mu g/m^3$	High volume PM_{10} sampling
Particulate matter $PM_{2.5}$	Annual arithmetic mean			15 $\mu g/m^3$	15 $\mu g/m^3$	Low volume $PM_{2.5}$ sampling
Particulate matter $PM_{2.5}$	24 hrs			65 $\mu g/m^3$	65 $\mu g/m^3$	Low volume $PM_{2.5}$ sampling
Lead (Pb)	Quarterly Arithmetic mean	1.5 $\mu g/m^3$	High volume sampling acid extraction and atomic absorption spectrometry	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	High volume sampling acid extraction and atomic absorption spectrometry
Hydrogen sulfide (H_2S)	1 hr	112 $\mu g/m^3$	Cadmium hydroxide extraction method			
Visibility	Observation	In sufficient amount to reduce the prevailing visibility to less than 30 miles when humidity is less than 70 %	Observer or camera			

3.1.2 Environmental Impacts

Air quality can be affected by reasonable and foreseeable exploration and development, by (1) an increase in particulate matter (dust), (2) release of gases and vapors and (3) noise. These are discussed below. These effects would most likely be greatest during the development and close-out phases.

3.1.2.1 Proposed Action

Direct Impacts – There are no direct air quality impacts to issuing leases for future geothermal exploration, development, and production activities.

Indirect Impacts – When considering the "reasonably foreseeable development scenario," any impact would be minor in nature and localized to a small area. Under this alternative the mitigation measures and stipulations for future leases would be established using an updated PEA and therefore, more stringent protection measures.

Particulate matter. Dust generated by the movement of exploration and construction vehicles over untreated local roads, and airborne dust resulting from earth moving, drilling activity, construction or wild fires, could add particulate material to the atmosphere. Depending on location, areas that are temporarily denuded of vegetation (e.g., roads, trails, drill pads, etc.) would be subject to a higher degree of wind erosion than normally associated with natural, undisturbed ground. Regolith areas or bare playas once disturbed would become sources of higher localized particulate pollution, particularly during dry periods in the spring and early summer months when low-pressure frontal systems move easterly through the area. Because of increased human activity with this action, a higher incidence of accidental range fires could result throughout the various stages of development. Wild fires can temporarily increase air pollution as well as cause other pronounced long-term resource damage.

A quantitative measurement of potential increases in particulate emissions as a result of this action is not possible since specific plans for operation or production may not be submitted until after leases are issued. The local air quality could be impacted by increased particulate concentrations from exploration, construction, and road composition (i.e., dirt and gravel roads). Mitigating measures should be created in later EAs. Adverse impacts to air quality could be reduced through dust suppression efforts such as applying water to roads and construction sites. A combination of restoration and natural re-vegetation should bring disturbed areas back to their natural condition. Based on the reasonably foreseeable development scenario, total surface disturbance from the proposed action would total approximately 605 acres (see Table 2.2-3). Comparing acreages of surface disturbance and the localized nature of the impacts, any adverse impacts to air quality would be minimal.

Gases. Motor vehicles used to move personnel and off-road construction equipment could contribute a negligible pollution load to the local atmosphere. Non-condensable gases such as carbon dioxide, methane, hydrogen, nitrogen, argon, carbon monoxide, hydrogen sulfide, radon, and ammonia vapors are often associated in varying amounts with geothermal development.

Although emitted in low concentrations, some of these gases could pose pollution problems and health hazards.

Hydrogen sulfide (H_2S), emitted from a well during testing, or from a cooling tower when a power plant is operating, has an unpleasant odor (rotten egg smell) at concentrations as low as 0.04 mg/m^3, but loses its odor at above 40 mg/m^3 and can cause severe eye injury and respiratory paralysis at exposure above 140 mg/m^3. H_2S concentrations must stay within standards to meet safety requirements. Basements, sumps, and trenches where it can accumulate as a result of its density being greater than that of air, should be monitored. It is assumed that during normal operations, all spent geothermal water is to be re-injected. However, with the exploration and testing phases, this may not be the case, and it is suggested that during such operations the H_2S emissions into the ambient atmosphere, as well as in the water be constantly monitored.

Condensed steam from geothermal development could contain contaminants, which if present in high concentrations, could be damaging to plant and animal life, depending upon mode of release. Terrestrial and aquatic animals ingesting natural food contaminated by emission fallout could be adversely affected. However, existing geothermal experience indicates that biotic problems of this nature are generally negligible.

The highest levels of gas and vapor emission would normally occur through venting during test drilling and production. Any accidental discharges during the rupture of pipelines or well blowout would also yield gases and vapors to the atmosphere. Cementing and capping wells during closeout would allow small amounts of gases and vapors to escape to the atmosphere. Overall impacts to air quality would be minor.

Noise. The noise level for any geothermal lease area can be expected to increase as the various phases of activity are implemented. The construction of access roads, test drilling, vehicular movement and other ancillary sound sources tend to raise background noise. Normally these are of relatively short duration and more of a disturbance factor rather than being associated with resource damage. Operations producing the greatest amounts of noise are air drilling, well testing and bleeding. By comparison, noise produced by a fully developed power producing steam field is modest, originating from the occasional venting from wells through mufflers and from pipeline leaks.

Upon closeout, wells are capped and cease to be a source of noise. If present, excessive noise levels can pose a health and safety hazard to nearby workers, are objectionable to area residents or visitors and could disturb wildlife distribution and breeding habits. Although it is presumed that noise could have an adverse impact on wildlife, such impacts should be short-term and minor.

3.1.2.2 No Action Alternative

Direct Impacts – There are no direct impacts to issuing leases for future geothermal exploration, development, and production activities.

Indirect Impacts – Indirect impacts from the No Action Alternative would be similar to those described in the Proposed Action; however, updated mitigation measures and stipulations would not apply using the 1982 Geothermal EA.